

Amendments to the Claims

- Claim 1. (currently amended) A biometric sensing apparatus, comprising:
a piezoelectric ceramic sensor having a plurality of piezoelectric ceramic elements arranged in an array, ~~each of said elements having an impedance that varies according to an applied load, said piezoelectric ceramic elements of said array being spaced on a pitch equal to or less than approximately 50 microns~~ ~~said sensor operating in an impedance mode and detecting to detect~~ features of a finger proximate to said ~~sensor array~~; and
a processor, coupled to said sensor, that receives an input from said sensor representative of features of the finger and produces an output.
- Claim 2. (original) The apparatus of claim 1, wherein said output is data representing a fingerprint pattern.
- Claim 3. (original) The apparatus of claim 1, wherein said output is data representing a portion of a finger ridge.
- Claim 4. (original) The apparatus of claim 1, wherein said output is data representing an arteriole-veinal map.
- Claim 5. (original) The apparatus of claim 1, wherein said output is data representing a bone map.
- Claim 6. (original) The apparatus of claim 1, wherein said output is data representing blood flow.
- Claim 7. (currently amended) The apparatus of claim +6, wherein said output is data representing arteriolar blood flow.

Claim 8. (currently amended) The apparatus of claim †6, wherein said output is data representing capillary blood flow.

Claim 9. (currently amended) The apparatus of claim †6, wherein said output is data representing a ratio of arteriole and capillary blood flow.

Claims 10-17 (cancelled)

Claim 18. (original) The apparatus of claim 1, wherein said sensor and said processor are packaged together as an integrated circuit.

Claims 19-22 (cancelled)

Claim 23. (original) The apparatus of claim 1, further comprising:
a multiplexer that couples said sensor to said processor.

Claims 24-53 (cancelled)

Claim 54. (currently amended) A biometric sensing apparatus, comprising:
a piezoelectric sensor having at least one hundred thousand approximately rectangular piezoelectric ceramic elements, each piezoelectric ceramic element having a size equal to or less than approximately forty microns by forty microns by one hundred microns, said sensor being responsive to features of a finger proximate to said sensor, said sensor operating in an impedance mode to produce impedance data; and
a processor, coupled to said sensor, that comprises an impedance detector that processes impedance data received receives data from said sensor and produces an output representative of features of the finger.

Claims 55-62 (cancelled)

- Claim 63. (previously amended) The apparatus of claim 54, wherein said output is data representing a fingerprint pattern.
- Claim 64. (currently amended) The apparatus of claim 54, wherein said sensor **further** operates in a Doppler-shift mode to produce Doppler-shift data, and said processor includes a Doppler-shift detector that processes Doppler-shift data received from said sensor to produce a second output.
- Claim 65. (previously amended) The apparatus of claim 64, wherein the second output is data representing blood flow.
- Claim 66. (previously amended) The apparatus of claim 65, wherein the second output is data representing arteriole blood flow.
- Claim 67. (previously amended) The apparatus of claim 65, wherein the second output is data representing capillary blood flow.
- Claim 68. (currently amended) The apparatus of claim 54, wherein said sensor **further** operates in an echo mode to produce echo data, and said processor includes a signal-time-of-travel detector that processes echo data received from said sensor to produce a second output.
- Claim 69. (previously added) The apparatus of claim 68, wherein the second output is data representing an arteriole-veinal map.
- Claim 70. (previously added) The apparatus of claim 68, wherein the second output is data representing a bone map.
- Claim 71. (currently amended) The apparatus of claim 54, wherein said sensor **further** operates in a voltage mode to produce voltage data, and said processor

includes a voltage detector that processes voltage data received from said sensor to produce a second output.

- Claim 72. (previously added) The apparatus of claim 71, wherein the second output is data representing a fingerprint pattern.
- Claim 73. (previously added) The apparatus of claim 1, wherein said processor includes an impedance detector that processes the input received from said sensor to produce the output.
- Claim 74. (previously added) The apparatus of claim 73, wherein the output is data representing a fingerprint pattern.
- Claim 75. (currently amended) The apparatus of claim 1, wherein said sensor **further** operates in a Doppler-shift mode to produce Doppler-shift data, and said processor includes a Doppler-shift detector that processes Doppler-shift data received from said sensor to produce a second output.
- Claim 76. (previously added) The apparatus of claim 75, wherein the second output is data representing blood flow.
- Claim 77. (previously added) The apparatus of claim 76, wherein the second output is data representing arteriole blood flow.
- Claim 78. (previously added) The apparatus of claim 76, wherein the second output is data representing capillary blood flow.
- Claim 79. (currently amended) The apparatus of claim 1, wherein said sensor **further** operates in an echo mode to produce echo data, and said processor includes a signal-time-of-travel detector that processes echo data received from said sensor to produce a second output.

- Claim 80. (previously added) The apparatus of claim 79, wherein the second output is data representing an arteriole-venal map.
- Claim 81. (previously added) The apparatus of claim 79, wherein the second output is data representing a bone map.
- Claim 82. (currently amended) The apparatus of claim 1, wherein said sensor further operates in a voltage mode to produce voltage data, and said processor includes a voltage detector that processes voltage data received from said sensor to produce a second output.
- Claim 83. (previously added) The apparatus of claim 82, wherein the second output is data representing a fingerprint pattern.
- Claim 84. (previously added) The apparatus of claim 1, further comprising:
an input signal generator that applies an AC voltage signal across said plurality of piezoelectric ceramic elements.
- Claim 85. (currently amended) The apparatus of claim 54, wherein ~~said piezoelectric sensor comprises a plurality of piezoelectric ceramic elements, and said apparatus further comprises comprising:~~
an input signal generator that applies an AC voltage signal across said at least one hundred thousand approximately rectangular piezoelectric ceramic elements.
- Claim 86. (new) A biometric sensing apparatus, comprising:
sensor means for detecting a print ridge pattern of a finger proximate to said sensor; and
a processor, coupled to said sensor, that receives an input from said sensor and produces an output representative of the print ridge pattern of the finger.

- Claim 87. (New) The apparatus of claim 86, wherein said sensor comprises an array of piezoelectric ceramic elements.
- Claim 88. (New) The apparatus of claim 87, wherein said array comprises at least 100,000 piezoelectric ceramic elements.
- Claim 89. (New) The apparatus of claim 88, wherein said piezoelectric ceramic elements of said array are spaced on a pitch equal to or less than approximately 50 microns.
- Claim 90. (New) The apparatus of claim 89, wherein said array is large enough to obtain data representing a fingerprint pattern.
- Claim 91. (New) The apparatus of claim 90, wherein said array comprises a sonic barrier between each of said piezoelectric ceramic elements.
- Claim 92. (New) The apparatus of claim 91, wherein said sonic barrier is air.
- Claim 93. (New) The apparatus of claim 91, wherein said sonic barrier is an epoxy containing micro-spheres.
- Claim 94. (New) The apparatus of claim 93, wherein said micro-spheres are vinyl.
- Claim 95. (New) The apparatus of claim 86, wherein said sensor means and said processor are packaged together as an integrated circuit.